upper and lower screw tractions, enables us to correct not only the antero-posterior curves but the greater part of the lateral curves as well. The amount of force exerted is kept always before us by means of a dynamometer.

To correct the displacement to the left of the body on the pelvis, we depress the right half of the seat. As this descends, dragging the hip with it, it recedes, causing a rotation to the right of the lumbar spine. As a consequence, the pelvis comes to lie in a frontal plane, more nearly parallel to that of the thorax and the lateral contours are improved. The asymmetry of neck and shoulders may be corrected by adjustable arm tractions. The prominent ribs, both in front and behind, are pushed in by pressure pads. These pads are incorporated in the jacket.

It is a principle of orthopedic surgery that *overcorrection* is essential to the cure of a deformity. Therefore here we may not be satisfied with a simple correction or re-adjustment to the middle position any more than we would be were we dealing with the correction of a clubfoot. We must aim to overcorrect—to transform a right dorsal into a left dorsal and a left lumbar into a right lumbar convexity; a kyphosis into a lordosis and a lordosis into a kyphosis, if our result is to be permanent.

To give the body the necessary twist, I use the posterior pressure pad, as a fulcrum and the shoulder tractions attached across the chest by a strap as the arms of a lever, by means of which I twist the thorax in the opposite direction to that taken by the dorsal torsion. The untwisting of the lumbar torsion is similarly exaggerated by means of a screw thread which enables the seat to be turned as a whole about its longitudinal axis. To better control lordosis, the seat is provided with a slide controlled by a screw.

With the patient fixed in the machine and the latter adjusted in such a way as to overcorrect, in so far as this is possible, each element of his deformity, I apply my plaster of Paris from his occiput and chin to his groins. When the plaster has hardened and dried I cut out great windows over the places where the ribs had originally been depressed. In this way I utilize the respiratory act in the attempt to force the ribs back to their normal position. With each succeeding jacket I attempt to improve my patient's contours till I believe I have brought him into a position of reversed distortion. How perfectly I can do this necessarily varies with the individual case.

Finally I remove his jacket and put him again upon his frame for a while, so that by massage and resistance exercises, given first in the horizontal and later in the erect posture, his muscles can again be brought to that state of tonicity which is essential to the maintenance of proper postures.

At some other time I may ask your indulgence while I place before you a scheme of what I believe to be the kind of resistance exercises appropriate to certain stages in the treatment of spinal curvature.

HYPOPHYSIS DISEASES AND THEIR DIAGNOSIS.*

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Vesalius appears to have been the first to describe this organ, and in his "De Corporis Humani Fabrica," 1553, he calls it the *"glans pituitam encipiens,"* under the mistaken idea that this organ secreted the "pituita" or nasal mucous. It is of interest to note here that in the lampreys the pituitary tube which remains during life opens on the dorsal aspect of the head, and, though it does not secrete the nasal mucous, it functions as an external nostril.

Soemmering in 1778 described the gland more fully, and termed it "hypophysis cerebri." Phylogenetically the Tunicata are the first to possess an organ comparable to the human hypophysis in the shape of a gland which opens into the pharynx. In the fishes we find a gland derived from the stomodoeum which comes in contact with a prolongation from the brain. Mammals possess a pituitary body having two distinct parts. In the human the pituitary body or hypophysis is a small reddish gray vascular mass of an oval form measuring about half an inch in its lateral diameter, and one-quarter of an inch in its antero-posterior and supero-inferior diameters, and weighing from five to ten grains. It is confined to a recess in the floor of the skull termed the pituitary fossa, being held laterally by the dura mater which forms the inner walls of the cavernous sinuses. It is very vascular and consists of two lobes. The anterior or inferior lobe much the larger and much the more vascular, is reniform in shape and receives the posterior lobe in its hilus or concavity.

Embryologically the anterior lobe arises as an upward diverticulum of the posterior wall of the primitive pharynx about the fourth week. This pouch of Rathke as it is called becomes nipped off by the developing base of the skull, and as a rare anomaly a remnant of this tube is found transversing the sphenoid bone whilst in men in the pharynx itself a remnant of the pituitary bud develops into a functionating tissue, and according to Haberfeld exists as a pharyngeal hypophysis. The nipped off epithelial cells of Rathke's pouch soon show a differentiation into two parts, one of which gives rise to the anterior lobe, while the other invests the body and neck of the posterior lobe, and to this investing layer of cells the special name of *pars intermedia* has been applied.

Microscopically the anterior lobe has an envelope and a faintly marked internal network of fibrous tissue. In the fibrous tissue meshes columns of cells are present which in young animals line, in older animals fill the alveoli. Sometimes a drop of amorphous material is present in the center of the cell mass, an acinus effect thus being produced, and occasionally the secreted substance is so abundant that the cells are pressed toward the periphery, it imitating as it were a thyroid vesicle.

These cells have been differentiated in accordance with their staining affinities. Thus we have

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chromophile and chromophobe cells, and the former have been subdivided into those having an affinity for the acid series of dyes, acidophilic cells, and those having an affinity for the basic series of dyes, basophilic cells. Whether each variety of cell has a different function or whether the varied appearances represent merely periods of varying function activity is still a question. Large blood sinuses are present throughout the sections of the anterior lobe, and the secretion of this lobe is said to find its way into the blood sinuses lying in the neighborhood.

The *pars nervosa* is somewhat rounded and measures only about one-sixth of an inch in diameter, and is applied to the hilus of the anterior lobe. It is an outgrowth from the embryonic neural cavity which soon becomes that of the third ventricle. During fetal life it is hollow and its cavity communicates with that of the ventricle by means of the infundibulum. In the adult human the infundibulum in its lower part becomes impervious. According to Gaskel's theory the stalk represents an ancestral mouth to which the ventricles of the brain and the central canal of the cord acted as the stomach and intestines. In the cat the posterior lobe remains hollow and in communication with the third ventricle through the open stalk.

As stated previously a part of the epithelial diverticulum of Rathke gives rise to cells which lie between the anterior glandular lobe and the prolongation from the third ventricle. They come to invest the *pars nervosa* and even form an external coating for the infundibulum, and in the cat a layer of these cells extends forward from the infundibular attachment. A few of the cells may penetrate more or less into the substance of the *pars nervosa.* These specially differentiated cells have been called by Herring the *pars intermedia,* and it together with the *pars nervosa* forms the posterior lobe which is thus partly glandular in origin. The *pars nervosa* itself is seen microscopically to be composed of neuroglia fibres and of neuroglia and ependymal cells.

The zone of junction of the anterior and posterior lobes, i. e., the so-called hilus, exhibits on microscopic examination a closed cleft representing the original space of the pharyngeal diverticulum. It is lined by a single layer of cubical cells, each possessing a large nucleus, and sometimes contains in its center an amorphous material. A few vesicles with similar content are to be found in the neighborhood and occasionally in the *pars nervosa* itself. They are lined by cylindrical cells which are said to be often ciliated.

Other vesicles, recalling by their appearance thyroid vesicles, are frequently to be seen in the mid-zone of this region. They exist as elongated cavities running from above downwards parallel to the blood vessels of the body of the gland, and are lined with cubical epithelial cells which possess a large nucleus. The vesicle content may be acidophile and resemble the thyroid colloid, or basophile and finely granular, or may be of a mixed character. The content may fill completely the vesicle cavity, or it may be retracted and the cavity also contain some enfoliated epithelial cells.

Posterior to the epithelial cleft are the cells composing the *pars intermedia.* These cells are ectodermal cells less developed than those which form the secreting structure of the anterior lobe. Colloid looking material may be seen between the cells of the *pars intermedia* in most sections, and appears to pass into the adjacent *pars nervosa,* and finally, according to Herring and Cushing, into the cavity of the third ventricle, though Edinger's work on the other hand suggests that the secretion from this lobe is carried backward into the brain tissue rather than into the cavity of the ventricle. Whether or not this colloid contains iodine is still a matter of dispute.

PHYSIOLOGY. Oliver and Shäfer in 1895 showed that intravenous injections of watery or glycerine extracts of the pituitary gland produced a remarkable elevation of arterial pressure, commencing more slowly and lasting longer than that produced by adrenal extract. Howell demonstrated that it was the extract prepared from the posterior lobe that had this effect, and that following the injection there was a preliminary fall of pressure lasting several seconds to a minute, and then a rise of twenty to thirty minutes' duration. The accompanying slowing of the heart lasted a little longer. With repeated injections the results became less marked and sometimes failed altogether. If the vagi were cut or atropine administered, the pressure rose higher, but the slowing of the heart was less marked. Shäfer and Swale Vincent later discovered that the extract of the posterior lobe contained two substances, one hypertensive re-injections of which led to an immunity to its action, the other hypotensive repeatedly effective, but only for a brief interval at a time. The rise of blood pressure that was produced was found to be associated with a general vaso-constriction having no relation to innervation by the sympathetic system. Thus the coronary and pulmonary blood vessels are affected in common with the arterioles of the system generally. Following the preliminary constriction of the renal vessels a dilatation ensues, with the result that an increased urinary secretion is produced. On the other hand the vaso-constrictor effect produced on the thyroid gland is said to be a prolonged one.

This posterior lobe extract further causes dilatation of the pupil, directly stimulates the musculature of the bladder, uterus and intestines, and gives rise to a diminished tolerance toward carbohydrate food or to an actual glycosuria. Daily injections over long periods of time lead to progressive emaciation often with marked degenerative changes in the spleen, and central necroses in the liver. The extract is absorbed slowly if at all from the stomach, and is destroyed by pancreatic digestion.

Injection of an extract of the anterior lobe leads to no recognizable immediate effect except in states of hypopituitarism when it causes a temporary pyrexia. Feeding of young rats with this lobe, however, causes, according to Shäfer, an exaggeration of their growth.

The injection then of extracts of the two lobes shows the curious paradox that the injection of the extract from the glandular lobe gives rise to little physiological effect compared to that resulting from the injection of the extract of the *pars nervosa,* and it is the extract from the *pars nervosa* itself rather than that from the investing *pars intermedia* as Osborne and Vincent have shown that is responsible for the results obtained. In explanation of this it may be suggested that the active posterior lobe extract is really produced in the gland cells belonging to the *pars intermedia,* but is activated on its way through the *pars nervosa,* and that the extract of the anterior lobe as injected represents an unactivated secretion.

Clinically many reports have been issued which tend to show that the effects produced in physiological animal experimentation are paralleled in human pathological conditions so that in extract of the posterior lobe of the hypophysis we have a therapeutic agent which deserves conscientious trial as a diuretic, as a hypertensive drug, as a stimulator of the slack uterus, of the paretic bowel and of the toxemic heart.

Though many experimenters had previously practised hypophysectomy in animals, it remained for Paulesco of Bucharest to devise a method of surgical approach which greatly facilitated removal of the gland, and to prove that its total ablation in dogs and cats was followed uniformly by death within a short time (twenty-four hours on the average). In those animals in which death did not occur he was able to demonstrate microscopically that the removal had been incomplete. He further showed that the quickly fatal result was due to the loss of the anterior lobe, and that ablation of the posterior lobe caused no immediate harmful effect. Further section of the stalk was comparable to a complete or nearly complete hypophysectomy.

Cushing and his co-workers in this country after most thorough experimental investigation find

1. That total removal of the hypophysis in the cat and dog leads inevitably to the death of the animal, that this is not due to surgical trauma or post-operative complications, and that incomplete removals produce no immediate disturbance. However, even in adult animals death need not occur as promptly as Paulesco claimed, whereas puppies may remain in an apparently normal condition for at least three weeks before terminal phenomena appear. Then the animal becomes unsteady, there is arching of the back, low temperature, shivering, coma and death in unconsciousness.

2. That the same symptoms after the same intervals of time follow the removal of the entire anterior lobe even though the posterior lobe remains in place.

3. That separation of the hypophyseal stalk owing to circulatory disturbances is comparable either to a partial hypophysectomy or to a total removal with immediate re-implantation of the excised tissue elsewhere in the body. The gland becomes reattached, but the pathway for the posterior lobe secretion may become obstructed by the scar leading to an accumulation of hyaline within the channels of the *pars nervosa.*

4. That partial removal of the anterior lobe leads in young animals to a persistence of the infantile type, and to lack of development of the secondary sexual characters, in older animals to adiposity and atrophy of the genitals.

5. The removal of the posterior lobe or permanent damaging of its function leads to a marked increase of tolerance toward carbohydrate food, there occurring at the same time a tendency to subnormal temperature, and to the acquisition of fat. Whether or not the convulsions and excessive sexual activity which have been seen in a few cases can be ascribed to the removal of this lobe is considered questionable.

Since the publication of Cushing's work Handelsmann and Sir Victor Horsley have issued a preliminary note recounting experiments upon cats, dogs and monkeys which seem to show that complete removal of the gland in the monkey at least is not incompatible with an indefinite continuation not only of life but also of good health.

They further state in contradistinction to Cushing that three of their dogs survived in health after complete removal of the anterior lobe. It may be that the results obtained in cats and dogs do not apply to men and monkeys, and that the presence of a functionating pharyngeal hypophysis may explain the discordant results reported with dogs.

Contemporarily Morawski reported that monkeys after permanent severance of the pituitary stalk survived indefinitely and exhibited no symptoms. He suggests that it is the opening of the third ventricle in the operation as performed on cats and dogs that leads to the lethal issue, but in view of the care evidenced in the reports of Cushing's work it seems much more probable that the anterior lobe of the gland in monkeys is not vitally dependent for its blood supply upon vessels which are cut through at the same time that section of the stalk is made. These reports, however, serve to bid us hesitate before we apply in their entirety to man the results obtained in experimentation upon cats and dogs.

Starling has suggested that the activities of the various parts of the primitive organism were coordinated by means of chemical products derived from glandular structures. These chemical products he termed hormones. In course of development the nervous system superseded the glandular structures as the chief coordinator, though still in the mammalian body both methods are employed. Not only are the internal secretions of many of these glands of direct vital importance, but the activities of one gland seem to be stimulated, checked or otherwise moderated by the secretion of some other gland, so that malfunction of one gland may not only produce a direct effect, but may throw out of gear the activities of a second gland which in its turn reacts perhaps on the first gland or upsets the functions of a third gland, and so on *ad infinitum.*

Experimentation and observation have shown that in castrated animals, e. g., in horses and cattle as in eunuchs the hypophysis is increased in size and weight. A similar perhaps characteristic change develops during pregnancy, and it has been suggested that the thickening of the facial tissues that

occurs during the pregnant state is dependent upon pituitary hyperactivity, and that the hypophysis is the organ which determines the time at which the birth of the child shall occur. After complete thyroidectomy the histological examination of the hypophysis suggests a condition of increased function. Partial hypophysectomy leads in its turn to atrophy of the testes, and to histological changes in the thyroid, in the islands of Langerhaus, and possibly in the thymus, adrenals and ovaries. Thus malfunction of one gland disturbs the interglandular equilibrium, and leads to a chain of symptoms the correct linking of which is extremely difficult.

It is evident that in diseased conditions of the hypophysis we may expect

1. Symptoms dependent upon a change in its secretion.

2. Symptoms dependent upon the new anatomical intracranial relations that arise.

1. *Symptoms dependent upon a change in its secretion.* Many years ago Woods Hutchinson epigrammatically termed the pituitary body the organ of growth, and it is not improbable that this gland directly or indirectly plays a marked role in the determination of an individual's stature, a variation of activity within the normal leading to a variation of growth within the normal, an active gland leading to a stature above, a sluggish gland to a stature below the mean.

If this be so, then if the gland activity be not confined during the period of growth within the limits of the normal we might expect correlated stature variations outside the mean range, a very active secretion leading to giantism, a very sluggish secretion leading to dwarfism, and this although the epiphyseal lines ossify at the customary periods.

We know that the secretions of other glands directly or indirectly have a similar influence; thus the capon, the steer and the eunuch present as is well known instances of an excess of growth which can be artificially induced by castration, a measure which also leads to an hypertrophied hypophysis.

On the other hand as far as we know at present the hypophysis presents no marked changes in the dwarfism that is associated with rickets, with achrondroplasia, with cretinism, or with defective renal or defective pancreatic activity.

Acromegaly. To Pierre Marie we are indebted for the first adequate description, in 1886, of, at that time, a new clinical entity, a disease characterized by an abnormal growth of the hard and soft tissues of the face, feet and hands.

The features exhibited by patients with this disease, the large spade-like hands with their padded eminences and sausage-shaped fingers, or maybe the elongated well-formed giant hands, the massive and long inverted oval-shaped face with its large nose, thick lips, accentuated supra-orbital ridges, prominent malar bones and projecting lower jaw, the enormous feet and the cervico-dorsal kyphosis are so well known to you as to merit only passing mention.

An association between this condition and a diseased hypophysis was soon noted, though for a long time it was surmised that it depended upon a suppressed function of the gland. To-day though it has been impossible to produce experimentally sufficient hyperfunction of the gland to give rise to the clinical features of the disease, yet the feeding experiments of Shäfer, the experimental work of Cushing, the post mortem examination of the gland in patients who have died whilst suffering from the disease, and above all the regression of symptoms that have so speedily followed partial removal of the diseased structure strongly suggest that acromegaly is directly associated with hypersecretion of the anterior lobe of the hypophysis.

It has been argued in confutation of this idea that acromegaly has occurred in individuals in whom at post mortem the gland was normal, but we know that anatomical size is not a correct criterion of physiological function, and it is possible that in some instances an enlarged pharyngeal hypophysis may have remained undiscovered.

According to the present views if this increased function of the anterior lobe be associated with increased posterior lobe activity, we might expect that a glycosuria or at any rate a diminished carbohydrate tolerance as tested by the ingestion of glucose or levulose, an increased blood pressure, polyuria and nutritional changes might be a part of the clinical picture, and such a combination of symptoms is presented by not a few of the patients.

The type of the disease, whether benign, lasting maybe fifty years, or chronic, lasting from eight to thirty years, or acute, lasting from three to four years, is naturally determined by the nature of the growth, which may be simply hyperplastic, frankly adenomatous or of a malignant character.

The relationship between this disease and giantism is admittedly a close one though the graphic conclusions of Brissaud and Meige that giantism is the acromegaly of youth, acromegaly the giantism of adult life, acromegalic giantism the same process beginning in youth and extending over into manhood are not universally accepted, for cases are on record in which acromegaly and giantism co-exist in young individuals. Partial giantism, a condition perhaps akin to acromegaly, may perhaps in some instances be due to pituitary malfunction.

Frohlich's Disease. *Dystrophia adiposa genitalis. Hypophyseal infantilism. Hypophyseal eunuchism.*

(By infantilism we mean the failure of the primary and secondary sexual characteristics to appear at their proper time, and this whether the general body growth be diminutive, normal or gigantic.)

To Fröhlich of Frankl Hochwart's clinic as to Marie we are indebted for the first adequate description of a symptom complex which may accompany some forms of hypophyseal disease. The syndrome consists of

1. An atrophy and decreased function of the organs of generation as evidenced by amenorrhea, failure of sexual desire and potency, and a deficiency of the head, chin, axillary and pubic hair.

2. Associated with these changes in the organs of generation is an excessive deposit of fat in the subcutaneous tissues of the trunk, of the genitals and within the abdomen. Accompanying this gen-

eral adiposity may be a dryness of the skin, a brittleness of hairs and nails similar to that occurring in myxedaema. Marked drowsiness is a common accompaniment.

If this disease begins before puberty, dwarfism and infantilism occur. In many cases the atrophic genitals may exhibit malformations such as hypospadias, kryptorchism, etc. In other instances feminine sexual characteristics may develop in males, and masculine sexual characteristics in females. Thus the male may exhibit abnormal mammary development, or a feminine type of pelvis, the female a masculine voice and an excessive growth of body hair.

In those patients in whom the disease develops later in life, adiposity, falling out of the hair, amenorrhea, loss of sexual desire and of sexual potency occur.

Not infrequently in this dystrophy the anomalies of the genital organs precede the adiposity, though cases are on record in which there is no reference to the occurrence of abnormalities of the functions of the organs of generation, perhaps due, as Pick suggests, either to defective observation or to failure to enquire into sexual history. On the other hand, excessive fat deposit may not occur, or at the time of death may have given place to a terminal cachexia.

The resemblance between the clinical picture as outlined and the condition depicted by Cushing as developing in animals after partial removal of the anterior lobe of the hypophysis is so striking that one is strongly tempted to ascribe this syndrome to pituitary anterior lobe hyposecretion. If the posterior lobe concomitantly exhibit diminished function we might surmise that an increased tolerance for carbohydrates, a low blood pressure and perhaps constipation and diminished urinary secretion might be found as a part of the clinical picture.

The pituitary tumor that is found in individuals so afflicted is often of a malignant nature, i. e., of such a character as to favor the probability of actual interference with pituitary function. Such a tumor may open into the sphenoidal sinuses and lead to a discharge of cerebro-spinal fluid from the nose, or may actually traverse the base of the skull and appear in the pharynx. The malignancy of these tumors is relatively low, and there is little or no tendency toward the occurrence of metastatic growths. Patients so afflicted may live for years. The question of function is rendered complex inasmuch as a number of case reports are on record in which the symptoms have been greatly mitigated by partial removal of the tumor, the improvement being perhaps due to relief from a pressure which interfered with remaining gland activity.

On the other hand not only may Frohlich's symptom complex occur with certain hypophyseal lesions, but an identical clinical picture may be presented by patients in whom at post-mortem the pituitary gland seems to be normal, the apparently causal lesion being found located outside the hypophysis, either in its neighborhood, in the third ventricle or in the posterior cranial fossa, an accompanying hydrocephalus being present. If of hyphophyseal origin the main growth may be above the level of the fossa inlet.

In view of these varied post-mortem findings it has been suggested that this dystrophy is dependent upon a lesion of the *pars nervosa* or of the gray matter in the region of the *tuber cinereum,* and it has been spoken of as a cerebral dystrophy. It is possible that through direct or indirect pressure the anterior lobe of the gland becomes inactive, or that the channels of outflow or absorption are so interfered with as to result in an inadequate quantity of anterior lobe secretion reaching the general circulation, and Cushing has suggested that the increase in weight, etc., that occurs late in some cases of intracranial growth is due to indirect interference with hypophyseal function.

This *dystrophia adiposa genitalis* presents not a few points in common with the Brissaud type of infantilism which is regarded as representing the mildest form of thyroid deficiency, and it is not improbable that mixed cases occur and that cases of one type have been wrongly catalogued as belonging to the other. The defective mentality, the absence of evidence of intracranial change, general or localized, and the big improvement manifested from thyroid administration will speak for thyroid origin in a doubtful case.

The mere determining that a patient presenting this syndrome is suffering from pituitary rather than from thyroid malfunction is not sufficient to locate the lesion within the hypophysis. If neighborhood symptoms are present, the lesion is probably within or around it. If, however, actual destruction, and not mere enlargement of the pituitary fossa, or evidences of an associated acromegaly be found, then we are justified in assuming that the lesion has definitely arisen within the gland. This is in striking contradistinction to acromegaly, the appearance of which, whether we regard it as due to a hyper or perverted secretion, definitely locates the lesion within the hypophysis.

Occasionally the infantilism that is found associated with a pituitary growth approaches the Lorain and Hastings Gilford types. In the former it will be remembered when adult age is reached the figure is small and slim and of a child's size though having the outlines of that of an adolescent whilst the organs of generation are immature. In the Hastings Gilford type there is a queer tendency to premature aging, the same dwarf-like creature presenting a curious combination of immature development and of premature old age. To what extent pituitary malfunction is responsible for these anomalies remains for future observation to determine.

Mixed Types. Not infrequently acromegalics present some of the features described as characteristic of the *dystrophia adiposa genitalis,* becoming unduly fat and impotent. It may be as Cushing suggests that the latter symptoms represent a later stage of a pure acromegalism, the nature of the tumor at first adenomatous, changing in character and becoming malignant, the hypersecretion associated with the former now being

replaced by the hyposecretion associated with the latter type of growth, a comparable change of function to that which occurs when myxedema follows exophthalmic goitre. But there are undoubted instances in which even in youth a mixed type occurs, giantism and acromegaly supposedly characteristic of an excessive gland function appearing in a patient exhibiting a rudimentary state of the organs of generation, and a complete absence of the secondary sexual characteristics.

It may be that the different cells described as occurring in the anterior lobe have different functions, one variety being associated with body growth, the other with the development of the sexual characteristics, and that both types of cells may or may not be concomitantly involved, or may or may not have their functions disturbed in like manner, or it may be even yet that both acromegaly and Frolich's disease are due to a perverted secretion of the hypophysis rather than to a mere excess or deficiency, or that the mixed type may be due to polyglandular insufficiency.

If the anterior and posterior lobes be regarded as glands having altogether separate functions, an idea which their close anatomical union hardly supports, it is evident that either a normal, excessive, diminished or perverted secretion of one lobe may be associated with either a normal, excessive, diminished or perverted secretion of the other lobe so that many possible combinations of gland malfunction may arise, and many mixed clinical pictures be produced.

Anomalous Types. The physiological action of the extract of the posterior lobe, and Cushing's work upon carbohydrate tolerance, etc., suggest that patients exhibiting glycosuria, obesity, polyuria, sexual anomalies, marked hyper or hypotension and cardio-vascular non-valvular insufficiency will need to be specially examined for evidences of pituitary involvement, and just as we have fruste types of thyroid malfunction so we will surely meet with fruste forms of hypophyseal disease.

How much the estimation of the carbohydrate tolerance and of the influence upon the changed tolerance of injections of posterior lobe secretion as outlined by Cushing will aid us diagnostically remains to be determined though the difficulties associated with the administration of the requisite amount of glucose or lactose are considerable, and the similar Strauss test employed in estimating hepatic function is, in my experience, of little value.

If it be definitely established that the posterior lobe secretion finds its way into the third ventricle then the examination of the patient's cerebro-spinal fluid may yield serviceable information.

Acute Pituitary Insufficiency. Whether true or relative pituitary insufficiency may arise during the course of fevers and toxemias as suggested by French writers is questionable. The apparent improvement of such patients after the use of the extract is, of course, very inconclusive evidence.

The Polyglandular Syndrome. How malfunction of one gland may lead to a syndrome due to the faulty interaction of many glands has been already alluded to. Many case records have been reported, particularly by the French writers, in which such a condition has been presumed to exist. We have all seen similar cases and in our present state of knowledge the elucidation of the exact train of events is most difficult. The diagnosis in many instances has been made to depend mainly upon the results obtained from combined glandular therapy, a means of diagnosis alluring but deceiving inasmuch as the extract derived from the gland principally at fault may exist in an unactivated condition, or may be stored within the gland in quantities insufficient to supply the bodily needs. The part which malfunction of the hypophysis plays in such a syndrome remains for the future to determine. It may perhaps be wise to mention here that the use of the pituitary extracts in these seeming pluriglandular diseases is contraindicated in conditions of high blood pressure, and that adrenal and pituitary extracts should not be simultaneously administered, and extract of adrenal body or adrenalin not be given in conditions of supposed hypophyseal hyperactivity.

2. *Symptoms dependent upon the new anatomical intracranial relations that arise.*

a. Anatomically the hypophysis is an intracranial organ and consequently tumor growths increasing its bulk commonly give rise to the characteristic symptoms indicative of increased intracranial pressure; viz: headache, vomiting, optic nerve changes.

Headache is seldom absent altogether, and sometimes is of intense severity. It appears as a rule as diffuse pains in the frontal region, and may exhibit a paroxysmal migrainous character.

Vomiting is a frequent symptom occurring according to Frankl Hochwart in 75% of cases.

Vertigo is less common, and spasmodic attacks rarely occur.

Choked disc and post-neuritic atrophy occur much less frequently than primary optic atrophy (perhaps in about 25% of cases).

Quite common are psychical changes, the patient becoming depressed, melancholic and physically and mentally torpid. A remarkable symptom which may occur is intense paroxysmal drowsiness, the attack lasting from hours to days or even weeks at a time. How much this is due to perverted gland function, and how much to indirect mechanical effect is undetermined. As with other intracranial growths late distance pressure symptoms may appear.

b. Symptoms due to neighborhood pressure effects.

Pressure upon the chiasma by the pituitary growth is a frequent finding, the anterior angle of the chiasma apparently receiving the most trauma.

As a result, impairment of vision in one or both eyes is often complained of. It may vary in degree from time to time with changes in the size of the growth, and may be associated with the appearance of a blue haze over everything. Later inability to see to the right or to the left, or a feeling as though the patient were walking between two high walls, and later still almost complete blindness may be prominent symptoms.

The use of the perimeter will demonstrate in

such cases marked alterations in the visual fields of which a bitemporal hemianopsia is the most common and most characteristic. Vision tends to be lost first in the upper portion of the temporal half of one field, perhaps involving the whole temporal half of the field of this eye before leading to a similar defect in the other eye. Later the bitemporal hemianopsia is apparent. The boundary line between the blind and seeing parts is hardly ever regular or vertical, and if so it generally passes through the point of fixation, a fact which helps to distinguish chiasmal lesions from lesions of the optic tract and cortical centers in which the macular field is spared. The absence of re-entering angles of contraction is noteworthy.

As the condition progresses the entire field of vision may be lost in one eye, the other still exhibiting a temporal hemianopic defect. Finally vision may be lost in the entire fields of both eyes.

Other variations in the visual fields are concentric contraction and central scotoma, but homonymous hemianopsia has been described. In some cases the color fields are definitely hemianopic while the fields for white may be almost full.

The ophthalmoscope commonly demonstrates a condition of partial or complete primary optic atrophy (50% of cases) though as previously mentioned choked disc or post-neuritic atrophy may be present (25%). The pupil reaction may be entirely lost or the hemianopic pupil phenomenon of Wernicke be exhibited.

2. Pressure upon other nerves in the vicinity. Large growths may press upon the third and sixth nerves, leading to weakness or paralysis of the structures supplied by them. Total ophthalmoplegia may be present, occasionally nsytagmus occurs. Trigeminal lesions are exceptional, but when present may lead to neuro-paralytic keratitis. Anosmia from pressure upon the olfactory nerves is not infrequent.

3. Pressure upon the cavernous sinuses may cause uni- or bilateral exophthalmos.

The use of the X-Ray in the diagnosis of pituitary disease. From the location of the pituitary fossa and the clearness with which the shadow of its normal outline can be seen upon a satisfactory radiogram, it was early surmised that the X-Ray would be of distinct diagnostic service in diseases of this organ. Oppenheim seems to have been the first to report a case which proved beyond all doubt the great service that the X-Ray could render. Since his report many radiograms good and bad have been published in the literature or exhibited at societies, and ingenious diagnoses made to rest upon the pathological conditions they were supposed to show. But as the minute anatomy of the pituitary fossa and the physiological variations which it and its adnexa might exhibit have received but scant attention in most anatomies (a striking exception, however, being that of Poirier's) it is readily understood that even good radiograms exhibiting changes well within the normal have been classified as pathological in character. However, Busi and Balli have of late, in an admirable article of which we make free use, drawn attention to the physiological variations that the fossa may present.

The radiographic technic is briefly as follows:

1. A point upon the orbito-auditory line fifty millimeters from its anterior end is marked.

2. The head of the patient is so placed upon the plate that its sagittal plane is parallel to the sagittal plane of the plate.

3. The tube target, at a distance of fifty centimeters from the plate, is centered over the point marked.

The vertical incident ray under these conditions will pass through the center of the floor of the fossa, and distortion effects are minimal.

The fossa itself is, of course, at some distance from the X-Ray plate, a distance varying with the width of the patient's skull, consequently each turn of the head on its vertical axis, and each tilting on its transverse axis alters considerably the picture of the cavity, and so it is very important to obtain as true parallelism as possible of head and plate.

Large variations in the direction of the incident perpendicular ray will produce similar effects, and Krause frankly states that in a not inconsiderable number of cases he has assumed widening of the *sella turcica* when autopsy revealed the contrary.

Radiographically the *sella turcica* may exhibit one of the following types which are arranged in the order of their frequency:

a. The three-quarter oval type.

b. The half circle type.

c. The three-quarter circle type.

d. The rectangular type, anterior wall and lamina quadrilateral constituting the shorter side of the rectangle.

The shape of the *sella turcica* bears no relation to the shape of the cranium, and between these four types there are numerous transitional forms.

Variations in size similarly occur.

The anterior-posterior diameter of the inlet varying in men from eight to fifteen millimeters.

The anterior-posterior diameter of the cavity varying from seven to fourteen millimeters.

The oblique diameter of the cavity varying from ten to sixteen millimeters.

The vertical diameter of the cavity varying from six to eleven millimeters.

Much importance has been ascribed radiographically to the shadow of the tubercle of the sella, but in normal radiograms it may be wanting, hardly visible or project like an acute angle, variations in its appearance leading to variations in the slope of the anterior wall.

The *dorsum sellae* is usually bent forwards and concave anteriorly, but may be vertical. It measures in height ten to eleven millimeters, and at its point of implantation measures in diameter five millimeters, about its middle four millimeters, less above. Normally, at any rate in men, it never appears as a thin line, and such thinning has a marked diagnostic importance indicating atrophy and destruction. Frequently in such cases the process is unduly high owing to an accompanying erosion of the floor of the pituitary fossa. As

destruction proceeds the shadow of the lamina quadrilateral disappears.

Contrary to many reports scant importance is to be attached to the shadow of the posterior clinoid process since they may be hidden within the shadow of the quadrilateral plate, may be physiologically absent or may appear to be present when absent.

The floor of the sella is sometimes level, sometimes slightly concave, sometimes deeply hollowed. It should appear as a fine regular opaque line. With faulty projection or when markedly depressed it may exhibit a double contour.

The anterior clinoid processes may throw shadows on the same level below or above that cast by the tubercle, and their inferior margin makes different angles with the anterior fossa wall. They are extra-sellar and it is unsafe to argue that the small inclined shadows sometimes cast by them result from atrophic processes within or above the fossa.

Abnormal clinoid processes are not infrequently physiologically present. They may prevent an exact interpretation of the shape of the sella, and if a bridge of bone unite the superior extremity of the quadrilateral plate with the anterior clinoid process it may be taken by the inexperienced for the floor of the fossa, as may also the shadow cast by the middle fossa of the skull.

In some plates shadows of increased density due to elevated bony bosses on the inner skull table appear within the cavity of the fossa. They must not be mistaken for concretions.

From the above description it is evident that while extensive changes of the fossa and its adnexa are recognizable at a glance much experience is needed before deciding that minor changes are indicative of diseased processes, and it must be remembered that destructive lesions other than those arising from the pituitary gland may involve the region of the fossa and its adnexa, and that a large fossa may be found in patients suffering from extra-hypophyseal intracranial growths or from hydrocephalus.

In addition to an abnormal fossa outline the radiogram of the acromegalic skull exhibits irregularity of the cranial parietes, enlarged frontal and maxillary fossæ, an exaggerated post lambdoidal prominence, and an enlarged prognathous jaw.

Variations in the symptomatology. Though change in bulk is commonly associated with change in function yet either one may occur whilst the other remains within the limits of the normal. Various combinations of symptoms and signs thus occur, sometimes those due to pituitary malfunction, sometimes those due to increased intracranial pressure, sometimes those due to local pressure effects being most in evidence. In other cases concomitant symptoms having no relation to the coexisting pituitary tumor are complained of. The occurrence of general and local pressure symptoms alone suggests a cystic growth. Syphilis and tuberculosis may occasionally attack the gland and be associated with lesions of like nature in other organs.

Some of the patients with pituitary disease will first visit the oculist, others the gynecologist, others the internist. There is no short road to their correct diagnosis. Familiarity with the subject at hand, a routine complete method of physical examination and of laboratory investigation, the use of the perimeter and the correct interpretation of technically good radiograms, these are the essentials which will enable us to recognize lesions of the hypophysis.

NOTE.

The literature dealing with the hypophysis is quite extensive. I have purposely omitted references, but would express my indebtedness in preparing this article not only to those named in the text, but also to Delille, Thaon, Herbert Fisher, Jameson Evans, and Melchior.

REPORT ON MEDICAL EDUCATION.*

By W. F. SNOW, M. D., Sacramento.

To the President, Thomas W. Huntington.

Dear Sir:

As representative from California, I attended the series of Conferences held in Chicago February 26th-March 1st, 1912, inclusive. These conferences were as follows:

1. Conference of A. M. A. on Medical Education.
2. Conference of A. M. A. on Medical Legislation.
3. Conference of A. M. A. on Public Health.
4. Conference of State Medical Examining & Licensing Boards.
5. Annual Meeting of Association of American Medical Colleges.

All of these meetings were well planned, full of interest, and well attended.

MEDICAL EDUCATION.

The most interesting discussions during the sessions on medical education centered about the subjects of practical examinations for the licensing of medical graduates; and the relation of the medical school to a fifth or hospital year.

Mr. Frederic G. Hallett, Secretary of the Conjoint Examining Board of England, presented in detail the successful practical examinations conducted by his organization. Mr. Hallett demonstrated that the practical part of the English examinations can be given properly at the rate of two hours and ten minutes for each twenty-four applicants. In the United States at least nine states have adopted some form of practical examinations. Among these Massachusetts, Ohio, Wisconsin, Colorado, Nebraska and Utah seem to have made considerable progress in this direction. New York is considering the acceptance of one year in an accredited hospital service in lieu of a practical examination. Indiana empowers the State

* Read before the Forty-Second Annual Meeting of the State Society, Del Monte, April, 1912.